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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/698,179	10/30/2003	Thomas W. Kenny	COOL-01302	2504

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EXAMINER	
FORD, JOHN K	

ART UNIT	PAPER NUMBER
3784	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/698,179	KENNY ET AL.	
	Examiner	Art Unit	
	JOHN FORD	3784	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 February 2012*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1,8-27,29-33,35-130,132,134 and 135* is/are pending in the application.

5a) Of the above claim(s) *9,11,15,18,20-27,33,35-37,39,42,43 and 45-127* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,8,10,12-14,16,17,19,29-32,38,40,41,44,128-130,132,134 and 135* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :2/17/12, 4/6/12 (2 documents) and 8/26/11.

Applicant's RCE filed 14 February 2012 has been carefully considered. Amendments have been made to claims 1, 132, 134 and 135. Claim 133 has been canceled. Significantly, counsel repudiates "the previous interpretation" in favor of a newly presented one set forth in the paragraph spanning pages 18-19 of the amendment filed 14 February 2012. The examiner has interpreted the words "the previous interpretation" (in counsel's remarks, above) to mean ***all*** previous interpretations. If the examiner's interpretation of counsel's intent is incorrect, counsel is required clarify the record. In the absence of any forthcoming clarification, the paragraph spanning pages 18-19 of the amendment filed 14 February 2012 is taken to be the controlling interpretation in so far as counsel is concerned. Having said that, claims, during examination, are given their broadest reasonable interpretation, whether or not that agrees with counsel's interpretation.

Independent claims 1 and 135 both specify that the fluid flows **from** the first of the one or more fingers **to** the second of one or more fingers. In addition, the first of the one or more fingers branches from the inlet channel before the end of the inlet channel. As well, the second of the one or more fingers branches from the first of the one or more fingers before the end of the first of the one or more fingers. The paragraph spanning pages 18-19 of the amendment filed 14 February 2012 clearly indicates that a passageway (Figure 3A, horizontal portion to the left of channel 116) that feeds two distinct fingers (118B and 118C) can be "attributed" to either of the two distinct fingers (118B and 118C) that are

connected to the passageway. Since "attributing" is now a permissible way of interpreting passages the examiner uses the same "attribution" principle (to coin a term for counsel's unusual manner of interpretation) in explaining the references with the understanding that counsel should have no objection since the "attribution" principle originated with him.

Applicant has elected (now shown in Figure 21) a species of Figures 3A-3B, wherein, instead of microchannel walls 110 as shown in Figure 3B, applicant now has, in Figure 21, replaced those microchannel walls 110, with a porous structure 110' that can be one of sintered metal or silicon foam. Among these two alternatives of material, applicant elected sintered metal.

An action on the merits follows on claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41, 44, 128-130, 132, 134 and 135. The remainder of the claims are designated as non-elected or have been canceled.

Applicant has previously concurred with the examiner's statement: "As the examiner understands it, claim 1 is directed to the heat exchanger, *per se*, while claim 128 is directed to the heat exchanger of claim 1 in combination with a heat source including 'at least one interface hot spot region'". New claim 135 is also concluded to be directed to the heat exchanger, *per se*.

Applicant's remarks with respect to the allowability of the claims however are not convincing and they are addressed in the rejections that follow.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 132 and 135 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

According to counsel's 2/14/12 interpretation, a first of one or more fingers can be 118B, extending in the "Y" direction in Figures 3B and 21 and a second of one or more fingers can be 118C, also extending in the "Y" direction in Figures 3B and 21. As would be understood by those of ordinary skill in the art those two fingers are obviously parallel. However, by the judicious application of counsel's "attribution" principle (discussed at the beginning of this office action) "portions" of fingers 118B and 118C are nonparallel (see paragraph bridging pages 18 and 19 of the response of 2/14/12).

The specification also states that the "fingers 118 [which includes 118B and 118C above], 120 extend completely through the body of the manifold layer 106 in the Z-direction as shown in Figure 3B. Alternatively, the fingers 118 and 120 extend partially through the manifold layer 106 in the Z-direction and have

apertures as shown in Figure 3A." It is therefore clear that fingers 118 extend in three directions "X", "Y" and "Z". Thus, with regard to claim 1, at least a portion of fingers 118B and/or 118C is nonparallel to the other according to counsel's "attribution" principle.

In claim 132, counsel has amended the claim to state that many of the passages, and the examiner is unsure of which ones in claim 132, lie in a "common plane" (the at least one inlet port, the inlet channel and the first of one or more fingers, the second of one or more fingers, or both lie in a common plane) because of the poor use of the conjunctions "and" and "or." Claim 132 is therefore ambiguous.

Additionally, and this is a problem in claims 132 and 135, all of the recited elements that supposedly "lie in a common plane" or in the "same plane" are three dimensional and a plane, by definition, is two dimensional. A three-dimensional passageway (e.g. any one of applicant's disclosed fingers, channels or ports) cannot exist entirely within the two dimensional world of a plane. It cannot be. It is therefore unclear how much of any three dimensional passageway (for example, in an accused infringing device, assuming these claims were patented) would have to exist "in the same plane" or "in a common plane" to meet or not meet the limitations in claims 132 and 135. Such limitations, as written, are submitted to be an invitation to a lawsuit and therefore vague and indefinite.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 8, 10, 12, 13, 14, 17, 19, 32, 38, 40, 128-130, 132, 134 and 135 are rejected under 35 U.S.C. 103(a) as obvious over the combined teachings of Gruber et al (USP 5,388,635) and Anderson et al (USP 5,761,037).

Gruber, assigned to IBM, shows in Figures 3, 4, 8A and 8B a system for cooling a heat source. An inlet port (analogous to port 108 in applicant's Figure 3b) is shown in Figure 8A at the very top of a cylindrical inlet passageway that extends downwardly in Figure 8A. Collectively, the aforementioned inlet port and cylindrical passageway below it (hereinafter "inlet port/passageway 28") are designated by reference numeral 28 in Gruber. The cylindrical inlet passageway directs fluid from the aforementioned inlet port to a middle channel 30 (the middle channel 30 in Figure 3 of Gruber) and the inlet port/passageway 28 together with the middle channel 30 in Figure 3 of Gruber are "attributed" (using counsel's "attribution" principle, discussed above) to be an "inlet channel." A first of one or more fingers, above and below the middle channel 30 in Figure 3 of Gruber, and

also designated by reference numeral 30 branch from this "inlet channel" (as explained above) before the end of the "inlet channel" (i.e. the channels 30 above and below the middle channel 30 in Figure 3 of Gruber branch from the "inlet channel" at the right side of Figure 3 of Gruber and the "inlet channel" ends at the left side of Figure 3). A second of one of more fingers (32) located at the right side of Figure 3 of Gruber branch from the first one of more fingers (i.e. the channels 30 above and below the middle channel 30 in Figure 3 of Gruber) before the end of the first of the one or more fingers (which first one of more fingers end at the top left side of Figure 3 and the bottom left side of Figure 3 of Gruber).

In the alternative, using counsel's "attribution" principle (discussed at the beginning of this office action) one could read any two adjacent fingers 32 (that are connected fluidly in parallel to an inlet channel 30) as first and second fingers that connect to an inlet channel 30 in the same manner that counsel reads fingers 118B and 118C as first and second fingers connected to an inlet channel 116 in Figure 3A of applicant's disclosure.

Regardless of which interpretation, discussed above, is used (or other interpretations, as may occur to the reader if counsel's "attribution" principle is applied to its fullest extent), these first fingers feed fluid to second fingers that, in turn, feed fluid to an intermediate layer (plate 16) that has a plurality of holes extending therethrough. A heat exchanger layer 14 includes micro-fins 56

defining micro-grooves 58 between them similar to applicant's Figure 3A-3B species. As explained by Gruber, the heat exchanger layer 14 can also be "fin-less". See col. 8, line 34-43, incorporated here by reference. If the heat exchanger layer 14 is "fin-less" Gruber states that it may have "a texture or structures to promote fluid stirring and heat transfer". Gruber discusses hot spots in col. 15, lines 1-41, incorporated here by reference.

Anderson, also assigned to IBM, shows a heat source 30 (an integrated circuit "chip") contacting a conducting portion 104 of a heat exchanger. A heat exchanging layer 103 of sintered copper (a microporous sintered metal according to applicant's own examples in his own disclosure) is shown and may be bonded to conducting portion 104. An inlet port connected to pipe 21 and an outlet port connected to pipe 11 are shown in Figure 4. While no particular region in Anderson's integrated circuit chip is disclosed as being hotter than another, arguably applicant's claim doesn't even claim an integrated circuit chip so the limitation is not given weight absent a claim to the overall combination. Notwithstanding that fact, it is apparent that the "hot spot region" 104 is cooled far more in the center than right at the edge because of the geometry of the device.

To have combined the teachings of Gruber and Anderson by attaching Anderson's wicking layer 103 to Gruber's heat exchanger "fin-less" layer 14 to promote heat transfer particularly when evaporating fluids would have been

obvious to one of ordinary skill in the art. Alternatively, to have used Gruber's fluid distribution system (i.e. everything above sheet 14 in Gruber) in place of the fluid distribution system of Anderson (i.e. everything to the left of sheet 103 in Figures 1 and 2 of Anderson) would have been obvious to one of ordinary skill in the art to advantageously achieve high flows with low pressure drop (a benefit explicitly stated by Gruber).

Regarding claim 10, see the outlet in Figure 4 of Anderson, connected to pipe 11. Also see outlet 46 in Gruber. Regarding claims 12 and 13 fluid inlet and outlet grooves are shown in Gruber. Claim 14, being a method of use limitation in an apparatus claim, is not a limitation on the apparatus itself (for further explanation, see MPEP 2114, incorporated here by reference). Regarding claim 17 there is no overhang shown between the layers in Gruber. Since there is no overhang and applicant's claimed range includes an overhang of "0" (i.e. zero) millimeters, this limitation is met. Regarding claim 32, every porous material by the nature of its formation is formed with irregular pores that inherently vary randomly over the flow path as a consequence of their random orientation. Regarding claims 38 and 40, see Figure 4 of Anderson wherein the body is at least thermally coupled to the integrated circuit chip.

The argument that Anderson does not have fingers branching out in different directions is similarly unavailing because Anderson was not relied upon to teach this feature.

In the July 9, 2009 amendment, applicant amended the claims (consistent with the modified specification of December 22, 2008) to specify that fluid flows from an inlet port (108) through an inlet channel (116) through a plurality of fingers (118, 120) through a plurality of conduits (105) extending through an intermediate layer (104) to a heat exchange layer (102). Gruber discloses flow through an inlet port/channel, through a first of one or more fingers, a second of one or more second fingers, through a plurality of conduits extending through an intermediate layer to a heat exchange layer.

Claims 1, 8, 10, 12, 13, 14, 17, 19, 32, 38, 40 and 128-130, 132, 134 and 135 are rejected under 35 U.S.C. 103(a) as obvious over the combined teachings of Gruber et al (USP 5,388,635) and Anderson et al (USP 5,761,037) and Chu et al (USP 3,993,123) or Frey et al (USP 5,978,220).

The rejection immediately above is incorporated here by reference. To have made the axis of the longitudinal cylindrical ports/channels 28 and 46 shown in Figures 8A and 8B of Gruber face outwardly in a direction parallel to the cooling surface of the heat exchange layer would have been obvious to one of ordinary skill in the art to advantageously facilitate connection between cold plates, as taught by Chu.

Similarly, to have made the axis of the longitudinal cylindrical ports/channels 28 and 46 shown in Figures 8A and 8B of Gruber face outwardly in a direction parallel to the cooling surface of the heat exchange layer would have been obvious to one of ordinary skill in the art to advantageously facilitate connection between cold plates, as taught by Frey at 5 and 6.

Claims 1, 8, 10, 12, 13, 14, 17, 19, 32, 38, 40, 128-130, 132, 134 and 135 are rejected under 35 U.S.C. 103(a) as obvious over the combined teachings of Gruber/Anderson or Gruber/Anderson/Chu/Frey as applied to claims 1, 8, 10, 12, 13, 14, 17, 19, 32, 38, 40 128-130, 132, 134 and 135 above and further in view of either Hou (USP 5,983,997) or Messina et al (USP 5,239,200).

Hou teaches forming different flow channel structures to provide different cooling rates to different parts of the heat transfer surface. Messina teaches the same thing in regard to the explanation of Figure 5, incorporated here by reference. In view of either of these teachings it would have been obvious to have structured the passageways and flow rates in Gruber/Anderson to concentrate cooling in certain areas of high heat load.

Applicant's arguments with respect to Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich all echo the arguments made with respect to Gruber and do not traverse that which Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich were relied upon to teach. Accordingly, applicant is deemed to have conceded

that Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich are properly relied upon by the examiner for what they have been relied by the examiner to teach.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gruber/ Anderson alone or Gruber/Anderson/Chu/Frey alone or in view of Hou or Messina as applied to claim 1 above, and further in view of Herrell (USP 4,758,926).

The thickness of layer 104 is not disclosed in Anderson. Gruber discloses a thickness of 375 micrometers (col. 12, line 59) which is 0.375 mm (within applicant's range of 0.3 to 0.7mm).

In Herrell layer 40 is 25 mils thick. Each mil is 25.4 microns. Layer 40 is therefore 635 microns thick. 635 microns is 0.635 millimeters, within applicant's claimed range. To have made the layer 104 of Anderson .635 millimeters thick (when used with Gruber's fluid distribution system) as taught by Herrell would have been obvious since it is shown by Herrell to be a dimension that works. Similarly to have made the same layer 0.375 mm as taught by Gruber because it also works would have been obvious to one of ordinary skill in the art.

Applicant's arguments with respect to Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich all echo the arguments made with respect to Gruber and do not traverse that which Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich

were relied upon to teach. Accordingly, applicant is deemed to have conceded that Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich are properly relied upon by the examiner for what they have been relied by the examiner to teach.

Claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruber/Anderson alone or Gruber/Anderson/Chu/Frey alone or in view of Hou or Messina as applied to claim 1 above, and further in view of Tonkovich (USP 6,680,044).

As disclosed the porosity of the porous microstructure should be such that heat exchange medium flows freely. With respect to claims 29-30 applicant has shown no criticality whatsoever and the art recognized tradeoff between getting adequate heat transfer and avoiding excessive pressure drop suggests that the variables being claimed are ultimately for the designer to select in any given heat transfer application. To have configured the porous intermediate layer of Anderson with a porosity that is known to provide good fluid flow as taught by Tonkovich in col. 2, lines 50-63, incorporated here by reference (teaching a porosity within applicant's claimed range as well as pore sizes in applicant's claimed range and a channel height with applicant's claimed range), would have been obvious to one of ordinary skill in the art to advantageously obtain extremely even cooling without any temperature gradients.

Applicant's arguments with respect to Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich all echo the arguments made with respect to Gruber and do not traverse that which Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich were relied upon to teach. Accordingly, applicant is deemed to have conceded that Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich are properly relied upon by the examiner for what they have been relied by the examiner to teach.

Claims 1, 8, 10, 12, 13, 14, 17, 19, 29, 30, 31, 32, 38, 40, 128-130, 132, 134 and 135 are rejected under 35 U.S.C. 103(a) as obvious over Gruber et al (USP 5,388,635) in view of the Jiang et al article "Thermal-Hydraulic performance of small scale micro-channel and porous-media heat exchangers".

Gruber, assigned to IBM, shows in Figures 3, 4, 8A and 8B a system for cooling a heat source. An inlet port (analogous to port 108 in applicant's Figure 3b) is shown in Figure 8A at the very top of a cylindrical inlet channel that extends downwardly in Figure 8A. Collectively, the aforementioned inlet port and cylindrical passageway below it (hereinafter "inlet port/passageway 28") are designated by reference numeral 28 in Gruber. The cylindrical inlet passageway directs fluid from the aforementioned inlet port to a middle channel 30 (the middle channel 30 in Figure 3 of Gruber) and the inlet port/passageway 28 together with the middle channel 30 in Figure 3 of Gruber are "attributed" (using counsel's "attribution" principle, discussed above) to be an "inlet channel." A first of one or more fingers, above and below the middle channel 30 in Figure 3 of Gruber, and

also designated by reference numeral 30 branch from this "inlet channel" (as explained above) before the end of the "inlet channel" (i.e. the channels 30 above and below the middle channel 30 in Figure 3 of Gruber branch from the "inlet channel" at the right side of Figure 3 of Gruber and the "inlet channel" ends at the left side of Figure 3). A second of one of more fingers (32) located at the right side of Figure 3 of Gruber branch from the first one of more fingers (i.e. the channels 30 above and below the middle channel 30 in Figure 3 of Gruber) before the end of the first of the one or more fingers (which first one of more fingers end at the top left side of Figure 3 and the bottom left side of Figure 3 of Gruber).

In the alternative, using counsel's "attribution" principle (discussed at the beginning of this office action) one could read any two adjacent fingers 32 (that are connected fluidly in parallel to an inlet channel 30) as first and second fingers that connect to an inlet channel 30 in the same manner that counsel reads fingers 118B and 118C as first and second fingers connected to an inlet channel 116 in Figure 3A of applicant's disclosure.

Regardless of which interpretation, discussed above, is used (or other interpretations, as may occur to the reader if counsel's "attribution" principle is applied to its fullest extent), these first fingers feed fluid to second fingers that, in turn, feed fluid to an intermediate layer (plate 16) that has a plurality of holes extending therethrough. A heat exchanger layer 14 includes micro-fins 56

defining micro-grooves 58 between them similar to applicant's Figure 3A-3B species. As explained by Gruber, the heat exchanger layer 14 can also be "fin-less". See col. 8, line 34-43, incorporated here by reference. If the heat exchanger layer 14 is "fin-less" Gruber states that it may have "a texture or structures to promote fluid stirring and heat transfer". Gruber discusses hot spots in col. 15, lines 1-41, incorporated here by reference.

The Jiang article discloses the art recognized equivalence of microchannel structures 56 and 58 of Gruber and porous microstructures as claimed by applicant currently. To have made the microchannel structures 56 and 58 of Gruber of microporous media as taught by the Jaing article would have been obvious to one of ordinary skill in the art. In general the microporous media is advantageous in terms of having better heat transfer than the microchannel structures 56 and 58 of Gruber as would have been obvious to have used for that reason in spite of their somewhat higher pressure drop (as disclosed explicitly in the Jaing article).

Regarding claim 8, the inlet port 28 and outlet port 46 are parallel to a plane. Regarding claim 13, grooves (i.e. long narrow channels) are shown in Gruber channeling fluid from one of the inlet and outlet to the fingers. Claim 14, is satisfied because Gruber does not disclose any boiling or vaporization of the heat exchange fluid. Alternatively claim 14, being a method of use limitation in an apparatus claim is not a limitation on the apparatus itself (for further

explanation, see MPEP 2114, incorporated here by reference). Regarding claim 17, in Gruber there is no overhang shown in Figures 13-15. Since there is no overhang and applicant's claimed range includes an overhang of "0" (i.e. zero) millimeters, this limitation is met by Gruber. Regarding claim 19, while the preferred material of manufacture in Gruber is metal and the metals listed in column 13, lines 3-14 have a higher conductivity than silicon, which is approximately 120 W/mK and can be looked up in standard handbooks, so claim 19 is met by Gruber. Metals, such as copper explicitly disclosed in Gruber, have an extremely high conductivity.

Applicant's arguments with respect to Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich all echo the arguments made with respect to Gruber and do not traverse that which Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich were relied upon to teach. Accordingly, applicant is deemed to have conceded that Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich are properly relied upon by the examiner for what they have been relied by the examiner to teach.

Claims 1, 8, 10, 12, 13, 14, 17, 19, 29, 30, 31, 32, 38, 40, 128-130, 132, 134 and 135 are rejected under 35 U.S.C. 103(a) as obvious over Gruber et al (USP 5,388,635) in view of the Jiang et al article "Thermal-Hydraulic performance of small scale micro-channel and porous-media heat exchangers" and Chu et al (USP 3,993,123) or Frey et al (USP 5,978,220).

The rejection immediately above is incorporated here by reference. To have made the axis of the cylindrical ports/channels 28 and 46 shown in Figures 8A and 8B of Gruber face outwardly in a direction parallel to the cooling surface of the heat exchange layer as taught by Chu would have been obvious to one of ordinary skill in the art to advantageously facilitate connection between cold plates.

Similarly, to have made the axis of the longitudinal cylindrical ports/channels 28 and 46 shown in Figures 8A and 8B of Gruber face outwardly in a direction parallel to the cooling surface of the heat exchange layer would have been obvious to one of ordinary skill in the art to advantageously facilitate connection between cold plates, as taught by Frey at 5 and 6.

Claims 1, 8, 10, 12, 13, 14, 16, 17, 19, 29, 30, 31, 32, 38, 40, 128-130, 132, 134 and 135 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruber in view of O'Neill et al (USP 4,896,719) and Tonkovich (USP 6,680,044).

Gruber, assigned to IBM, shows in Figures 3, 4, 8A and 8B a system for cooling a heat source. An inlet port (analogous to port 108 in applicant's Figure 3b) is shown in Figure 8A at the very top of a cylindrical inlet channel that extends downwardly in Figure 8A. Collectively, the aforementioned inlet port and cylindrical passageway below it (hereinafter "inlet port/passageway 28") are

designated by reference numeral 28 in Gruber. The cylindrical inlet passageway directs fluid from the aforementioned inlet port to a middle channel 30 (the middle channel 30 in Figure 3 of Gruber) and the inlet port/passageway 28 together with the middle channel 30 in Figure 3 of Gruber are "attributed" (using counsel's "attribution" principle, discussed above) to be an "inlet channel." A first of one or more fingers, above and below the middle channel 30 in Figure 3 of Gruber, and also designated by reference numeral 30 branch from this "inlet channel" (as explained above) before the end of the "inlet channel" (i.e. the channels 30 above and below the middle channel 30 in Figure 3 of Gruber branch from the "inlet channel" at the right side of Figure 3 of Gruber and the "inlet channel" ends at the left side of Figure 3). A second of one of more fingers (32) located at the right side of Figure 3 of Gruber branch from the first one of more fingers (i.e. the channels 30 above and below the middle channel 30 in Figure 3 of Gruber) before the end of the first of the one or more fingers (which first one of more fingers end at the top left side of Figure 3 and the bottom left side of Figure 3 of Gruber).

In the alternative, using counsel's "attribution" principle (discussed at the beginning of this office action) one could read any two adjacent fingers 32 (that are connected fluidly in parallel to an inlet channel 30) as first and second fingers that connect to an inlet channel 30 in the same manner that counsel reads fingers 118B and 118C as first and second fingers connected to an inlet channel 116 in Figure 3A of applicant's disclosure.

Regardless of which interpretation, discussed above, is used (or other interpretations, as may occur to the reader if counsel's "attribution" principle is applied to its fullest extent), these first fingers feed fluid to second fingers that, in turn, feed fluid to an intermediate layer (plate 16) that has a plurality of holes extending therethrough. A heat exchanger layer 14 includes micro-fins 56 defining micro-grooves 58 between them similar to applicant's Figure 3A-3B species. As explained by Gruber, the heat exchanger layer 14 can also be "fin-less". See col. 8, line 34-43, incorporated here by reference. If the heat exchanger layer 14 is "fin-less" Gruber states that it may have "a texture or structures to promote fluid stirring and heat transfer". Gruber discusses hot spots in col. 15, lines 1-41, incorporated here by reference.

To have replaced the microchannel layer 14 of Gruber with the corresponding porous layer construction of O'Neill (i.e. skin 15 and adjoining expanded foam 25) would have been obvious to one of ordinary skill in the art to advantageously obtain extremely even cooling without any temperature gradients as would occur when there were discrete heat transfer zones as is the case in Gruber. Note that porous microstructures have better heat transfer characteristics than microchannels as evidenced by Jiang et al article "Thermal-Hydraulic performance of small scale micro-channel and porous-media heat exchangers." Here the Jaing article is only relied upon to show an inherent property of porous microstructures compared to microchannels.

As disclosed the porosity of the expanded foam should be such that heat exchange medium flows freely. With respect to claims 29-30 applicant has shown no criticality whatsoever and the art recognized tradeoff between getting adequate heat transfer and avoiding excessive pressure drop suggests that the variables being claimed are ultimately for the designer to select in any given heat transfer application. To have configured the porous intermediate layer of Gruber/O'Neill with a porosity that is known to provide good fluid flow as taught by Tonkovich in col. 2, lines 50-63, incorporated here by reference, would have been obvious to one of ordinary skill in the art to advantageously obtain extremely even cooling without any temperature gradients as would occur when there were discrete heat transfer zones as is the case in Gruber.

Applicant's arguments with respect to Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich all echo the arguments made with respect to Gruber and do not traverse that which Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich were relied upon to teach. Accordingly, applicant is deemed to have conceded that Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich are properly relied upon by the examiner for what they have been relied by the examiner to teach.

Claims 1, 8, 10, 12, 13, 14, 16, 17, 19, 29, 30, 31, 32, 38, 40, 128-130, 132, 134 and 135 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Gruber in view of O'Neill et al (USP 4,896,719) and Tonkovich (USP 6,680,044) and Chu et al (USP 3,993,123) or Frey (USP 5,978,220).

The rejection immediately above is incorporated here by reference. To have made the axis of the cylindrical ports/channels 28 and 46 shown in Figures 8A and 8B of Gruber face outwardly in a direction parallel to the cooling surface of the heat exchange layer as taught by Chu would have been obvious to one of ordinary skill in the art to advantageously facilitate connection between cold plates.

Similarly, to have made the axis of the longitudinal cylindrical ports/channels 28 and 46 shown in Figures 8A and 8B of Gruber face outwardly in a direction parallel to the cooling surface of the heat exchange layer would have been obvious to one of ordinary skill in the art to advantageously facilitate connection between cold plates, as taught by Frey at 5 and 6.

Claims 41 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over any of the prior art references as applied to claim 1 above, and further in view of Cardella (USP 5,918,469) or WO 01/25711 A1 (cited by applicant).

Cardella teaches a thermoelectric cooler 24 between a heat source (an integrated circuit chip 22) and a liquid-coolant type heat exchanger 20. To have

inserted a thermoelectric cooler between each of the integrated circuits of Gruber (in combination with the other prior art discussed above) and the bottom layer of Gruber (in combination with the other prior art discussed above) to advantageously cool the integrated circuits even more would have been obvious to one of ordinary skill in the art in view of Cardella. Alternatively, to have replaced heat exchanger 20 of Cardella with the microchannel heat sink assembly described in the above rejections to advantageously improve cooling in Cardella would have been obvious to one of ordinary skill in the art.

Finally, to have replaced either or both of the heat sink assemblies of WO 01/25711 A1 (cited by applicant) best seen in Figure 2 (18 and 19 at the bottom and 15 and 16 at the top) with the heat sink assembly of Gruber (in combination with the other prior art discussed above) would have been obvious to one of ordinary skill in the art to improve the cooling performance by advantageously reducing the length of the fluid flow paths.

Applicant's arguments with respect to Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich all echo the arguments made with respect to Gruber and do not traverse that which Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich were relied upon to teach. Accordingly, applicant is deemed to have conceded that Andersen, Hou, Messina, Jaing, ONeill, and Tonkovich are properly relied upon by the examiner for what they have been relied by the examiner to teach.

Claim 132 and 135 are rejected under 35 U.S.C. 103(a) as being unpatentable over any of the prior art as applied to claim 1 above, and further in view of Flint et al (USP 4,759,403).

To have made the inlet port of Gruber, inlet channel of Gruber, first of one or more fingers of Gruber, the second of one or more fingers of Gruber, or both of Gruber in a manner such that flow flows only in a direction parallel to the bottom of the surface of the body would have been obvious from the teaching available to one of ordinary skill in the art from Figures 6 and 9 of Flint et al (USP 4,759,403), which teach an inlet port (at the right side of inlet channel 120), an inlet channel (120), a first of one or more fingers (the first one or more fingers that connect the left side of inlet channel 120 to each of the second of one or more fingers 88), the second of one or more fingers (88) or both that lie in a common plane. Such a modification would advantageously simplify fabrication of the cover.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory

action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John K. Ford whose telephone number is 571-272-4911. The examiner can normally be reached on Mon.-Fri. 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frantz Jules can be reached on 571-272-4834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John K. Ford/
Primary Examiner, Art Unit 3784